**IT Skills & Experience**

I am proficient in LabVIEW and Igor programming languages. In addition I have some experience with Matlab, Scilab and Python. I have extensive experience with Microsoft Office and Open Office packages as well has Origin Graphing Software. I am also capable of creating quality images and posters using with CorelDraw and Inkscape vector-graphic packages.

1. **Scientist:** A degree (2:1 or above, or equivalent) in physical sciences and a PhD (or equivalent experience) in a relevant scientific research discipline e.g. atmospheric science, physics, chemistry, engineering, Earth sciences. **Senior Scientist:** Significant post-doctoral (or equivalent) experience in a relevant research discipline and a proven track record of planning and delivering research projects.

I received my M.Sci in Chemistry (2:1) from the University of Bristol in 2010 and my PhD from the same institution in 2014, working in the Bristol Aerosol Research Center under Prof. Jonathan Reid. The main focus of my PhD was to develop a cavity ring down spectrometer (CRDS) for optical, hygroscopic and mass flux measurements. I performed this work in the laboratory on both ensembles of aerosols and on single aerosol particles. Aerosol ensembles were generated using an atomizer, size selected using a DMA and then probed using a 532 nm CRDS to determine the extinction coefficient. The refractive index of the aerosol ensemble at a variety of humidities could be determined using the extinction coefficient in combination with the aerosol number density, measured using a CPC. Unfortunately, the accuracy of this refractive index determination was limited by knowledge of the size distribution of the aerosol ensemble. The single particle CRDS system allowed the refractive index and radius of a single trapped particle to be tracked over time without such uncertainty.

In September 2014 I started my first post-doctoral position working with in the Chemical Sciences Division of the National Oceanic and Atmospheric Association in Boulder Colorado. The focus of this work was to develop and better characterize the performance of a multi-wavelength CRDS combined photo acoustic spectrometer (PAS) instrument. This characterization has involved field testing, comparison studies and laboratory sensitivity tests. This instrument is capable of measuring absolute absorption and extinction coefficients and, as a result, single scattering albedo.

1. Evidence of good understanding of atmospheric aerosol, cloud physics and/or radiation science.

Due to my work with aerosol CRDS instruments I have a good knowledge of light particle interactions in the Mie regime and have written simulations of such interactions using the programming language, Matlab. In addition, I have a good understanding of the influence of hygroscopicity, volatility and phase separations on the component concentrations of aerosol particles and, thus, on light scattering and absorption properties.

Working with a photoacoustic spectrometer has allowed me to better understand the role of absorbing aerosol in the atmosphere. In addition, working at NOAA means that I better appreciate the logistics of field deployment of an instrument and problems faced when performing flight measurements.

1. Evidence of strong instrument knowledge and aptitude for practical research.

Throughout my Ph.D I developed optical, gas flow and instrument communication systems.

The main optical system I constructed during this time was the single particle CRDS instrument. This consisted of a trapping part that allowed a single particle to be suspended within a cell and a bisecting CRDS. The CRDS consisted of a CW, AOD modulated laser and particle was optically trapped using a Bessel beam (a spatially manipulated laser beam where the transverse intensity profile can be described using a Bessel function). Bessel beams allow single or chains of particles to be optically isolated by using a multiple such beams or a single Bessel beam with a gas flow. The most common trap that I used consisted of a vertically propagating Bessel beam and a counter-propagating gas flow. In combination with a PID laser feedback this allowed control over the particle position in 3 dimensions enabling us to maneuver the particle into the center of the ring-down beam. Creating user-friendly data acquisition software for this instrument (written in LabVIEW) was an important part of its development. The flow systems were generally designed to be able to trap single particles in combination with the Bessel beam and for humidification of the aerosol.

During my current postdoctoral research I have worked with multi-wavelength, ensemble cavity ring down spectrometer (CRDS) combined photo-acoustic spectrometer. I have worked to characterize the instrument performance in the laboratory and to compare the instrument to other more commonly used optical measurements (nephlometer, PSAP).

1. Evidence of ability to analyse and interpret data to construct robust scientific arguments that lead to research output.

Statistical significance is a very important part of almost any data collection or analysis. I am always keen to make sure that I know the accuracy and precision of my measurement and be aware that it this can change under different experimental or environmental conditions. It is important to me to collect an appropriate amount of data be able to draw a statistically significant conclusion.

During my work on the single particle CRDS instrument I had to characterize several key features of the single particle CRDS measurement. The analyses are available in detail my two most recent publications (see publication list). In order to briefly summarize these analyses it is important to understand that a typical measurement involved varying the size and/or composition of a particle over time. For example, an aqueous ammonium sulphate particle could be trapped at high (>90 %) humidity and then slowly dried until it was ejected from trapped (ejection often occurred when the particle effloresced). For processing this data, I was required to develop Mie fitting algorithms that varied the refractive index, CRDS beam waist and radius in order to determine the changing particle refractive index as a function of size. In addition, as the typical radius of the particle was between 0.5 and 2 microns, its position within the ring down standing wave had to be incorporated into these simulations. In extinction efficiency (or cross-section) space, as a function of particle radius, this manifests as an envelope in extinction.

As part of my postdoctoral work I have become involved in processing more extensive instrument data. This has included a small project of analyzing absorption, flight data taken in 2012. Although I still have a lot to learn, I am keen to develop my skills of processing and comparing large amounts of instrument data.

1. Proven ability to generate innovative solutions to scientific problems and to learn new techniques as necessary to overcome obstacles.

One of the largest challenges I had to overcome during my PhD was in building an optical system that allowed micron precision control over the position of an optically trapped particle in 3 dimensions. A particle could be trapped using a Bessel beam (section 3) but it had to be confined in the centre of a ring down beam. Control in two dimensions (x and y with respect to the beam propagation direction) was fairly easily achieved using adjustable stages for the final optic of the Bessel beam. An issue with this is that as the size of the particle changed so did the radiation pressure efficiency it experienced. This meant that the Bessel beam power required to keep the particle in the centre of the ring down beam continuously changed in a non-linear way. In order to keep the particle in a fixed position an equivalent of a PID feedback for the laser power was built and achieved stable control of the particles position in 3 dimensions.

Currently I am assessing the performance of the CRDS-PAS instrument and this requires some instrument redesign. I am in the process of helping to modify our ozone generator (currently used to calibrate the PAS) so that we can have finer control of O3 concentration that we flow through the instrument and thus allow us to accurately determine different time-averaged detection limits for the PAS instrument. As our CRDS-PAS is a flight instrument it will also important to appreciate how the signal from the PAS (a microphone signal) varies as a function of pressure.Evidence of strong scientific programming skills in one or more high level computing language (e.g. Python, IDL).

During my Ph.D I used LabVIEW for instrument-computer communication. The legacy of the research group I worked in meant that LabVIEW was used for most of the data analysis as well (which is not optimal). I used a small amount of Matlab and Scilab for writing larger scripts, such as Mie code. During this time I used Excel, Origin and Coreldraw for generating figures.

During my postdoc I have been using Igor to write routines for data analysis and generating journal quality figures. Although I have only used a little Python, I would be very keen to learn more.

1. Proven ability to work effectively as part of a dynamic, multidisciplinary team.

It has always been very important for me to effectively communicate with those around me. Whether I’m working on a project alone or with others, I like to talk the projects methods and reasoning. Earlier this year I worked on a project (HAGiS) with several other teams of people working to develop understanding of aerosol hygroscopicity within the Boulder area.

As part of an ongoing comparison measurement that I’m currently working on I’m communicating every day with the team operating the other instruments. In this way we can talk through how previous measurements, agreements and discrepancies, inform the types of measurements moving forward with the comparison.

I have always been keen to socialize with my colleagues outside of work hours. I believe that building good relationships helps with effective communication and co-operation within the lab.

1. Evidence of strong written and verbal scientific communication skills.

I have given several talks and posters at different conferences including oral presentations at the European Aerosol Conference in Granada and at an Aerosol Society Conference in Leeds. I had three first author publications during my PhD and contributed to a further 3. The details of these publications are available in my CV publication list.

**Desirable**

1. Experience of conducting atmospheric aerosol research (field and/or model-based).

I have been involved in a small-scale multi-instrument measurement sampling ambient, ground-level aerosols within Boulder (HAGiS). Otherwise, I have limited experience conducting field research.

1. Proven expertise in one or more specialist techniques used for atmospheric research, e.g. LIDAR, optical spectroscopy, optical particle counting, radiometry.

Cavity ring-down spectrometers (4.5 years): Extensive experience in developing, aligning and processing the data of CRDS instruments.

Photoacoustic Spectrometers: Reasonable experience (10 months) in operating, operating principles and data processing of photoacoustic spectrometers.

Nephlometers: Reasonable experience (6 months) of the operating principles, calibration and operation.

Size selection and particle counting: I have used CPCs and DMAs as part of my PhD and postdoc.

1. Fit and willing to fly on an atmospheric research aircraft.

I run 3 or 4 times a week and cycle to work on most days (3+ miles each way). I have a chronic chest condition called Costochondritis which causes inflammation of cartilage in my chest. This condition is usually mild and doesn’t often affect my day to day work but very occasionally prevents me from lifting heavy objects. Otherwise I’m in good shape. I am willing to fly on research aircraft (although I may get travel sick!).

When working on the single particle CRDS instrument I had to write analysis software that interpreted the ring-down and angularly resolved light scattering data collected from a photo-diode and camera respectively. The light scattering data, or phase function, was collected over a wide angular range at a position centered at 90 from the laser propagation. This manifested an interference pattern, or as a series of bands of light where the number and width of the bands and, by comparison with Mie simulations, can be used to determine the particle radius.